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# Emotional management and biological markers of dietetic regimen in chronic kidney disease patients

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**ABSTRACT**

The aim of the study was to investigate the association between psychological characteristics and biological markers of adherence in chronic kidney disease patients receiving conservative therapy, hemodialysis, peritoneal dialysis (PD), or kidney transplantation.

Seventy-nine adult patients were asked to complete the following questionnaires: Toronto Alexithymia scale, Snaith–Hamilton Pleasure Scale, and Short Form Health Survey. Biological markers of adherence to treatment were measured.

Peritoneal dialysis patients showed a lower capacity to feel pleasure from sensorial experience ($p = .011$) and a higher values of phosphorus compared to the other patients' groups ($p = .0001$).

The inability to communicate emotions was negatively correlated with hemoglobin levels ($r = -(0).69$; $p = .001$) and positively correlated with phosphorus values in the PD patients ($r = .45$; $p = .050$).

Findings showed higher psychological impairments and a lower adherence to the treatment in PD patients and suggest the implication of emotional competence in adherence to treatment.

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Hemodialysis; alexithymia; kidney disease; renal failure; quality of life

## Background

The prevalence of chronic kidney disease (CKD) is 11% of the adult population in the United States (19.2 million): 5.9 million have stage 1 of CKD (persistent albuminuria with normal glomerular filtration rate), whereas the remaining 13 million have variable degrees of kidney dysfunction, from mild to severe functional impairment.[1]

Previous studies showed that end stage renal disease (ESRD) patients undergoing peritoneal dialysis (PD) or hemodialysis (HD) presented lower adherence, higher psychological distress, and lower quality of life compared to healthy subjects.[2,3] Moreover, lack of adherence and higher psychological distress seem to contribute to a greater morbidity and earlier mortality in CKD patients.[2]

Others studies reported that HD patients showed lower levels of quality of life compared to patients on PD treatment,[4] and that kidney transplantation (KT) patients showed higher quality of life compared to patients undergoing other different therapies.[5–7]

Many studies investigated on the health and quality of life in ESRD.[8–10] The comparisons between HD and PD on the health related quality of life produced conflicting results.[8] Many studies suggested that PD patients perceived lower distress and higher psychological well-being compared to patients undergoing other replacement therapies.[9,10] The fact that PD treatment allows patients to receive the treatment at home avoiding in-hospital care could be the reason for the lower distress in these patients.

Some studies showed that impairments in emotional ability, that seems to be a risk factor for mortality,[11] could occur as a reaction to the ESRD in HD patients.[10] Moreover, many studies demonstrated that psychological disease can affect adherence to medical treatment[12] and a recent review showed that non-adherence is a persistent concern in PD patients. In the therapy planning of ESRD patients, it seems very

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important to take into consideration adherence behavior of patients in order to improve outcomes.[13]

On the bases of these findings, it seems mandatory to explore which psychological characteristics are associated with adherence behaviors.

The aim of the present study was to investigate the association between psychological impairments and biological markers of adherence in CKD patients managed with different kinds of treatment (PD, HD, KT, and conservative treatment, CT).

The hypothesis was that PD and HD patients will show higher psychological impairment and lower adherence to treatment compared to CT and KT patients.

## Methods

### Participants

Following local Ethical Committee approval, 79 adult patients with CKD were recruited in three different centers of dialysis in Italy from March 2013 to October 2013. Inclusion criteria were: age between 39 and 80 years, level of education no lower than primary school, Italian or foreign citizenship with knowledge of Italian language, and absence of psychopathological diagnoses.

The sample was differentiated in patients treated with PD ($n = 39$), with hemodialysis ($n = 35$), with conservative therapy ($n = 16$) and nine transplanted patients (KT).

### Procedure

During a follow-up nephrological visit, a psychologist, after delivery of informed consent, asked to patients to complete three questionnaires: Short Form Health Survey (SF-36), Snaith–Hamilton Pleasure Scale (SHAPS), and Toronto Alexithymia Scale (TAS-20).

### Measures

The SF-36 contains 36 questions that assess eight aspects of Quality of Life: physical functioning (PF), role-physical functioning (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional functioning (RE), and mental health (MH). For each question, a score from 0 to 100 is given. Higher scores reflect better functioning. Internal consistency, test–retest reliability and validity of the content range from 0.68 to 0.93, 0.60 to 0.81, and 0.42 to 0.84, respectively.[14]

The SHAPS is a brief 14-item self-report questionnaire that intends to measure hedonic tone and its absence, anhedonia. These 14 items cover four domains of hedonic experience: interest/pastimes, social interaction, sensory experience, and food/drink. The SHAPS showed adequate psychometric properties in clinical and healthy samples. The internal consistency was 0.91. A one-factor solution emerged for the SHAPS (Eigenvalues of the first two initial factors were 5.95 and 0.43, respectively). The SHAPS is a reliable, valid, and unidimensional instrument used to assess the hedonic capacity in adult samples.[15]

The TAS-20 is a self-report scale comprised of 20 items.[14] Each item is rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The first factor (F1) in the three-factor model for the TAS-20 consists of seven items assessing the ability to identify feelings and emotions and to distinguish them from the somatic sensations that accompany emotional arousal. Factor 2 (F2) consists of five items assessing the ability to describe feelings and emotions to other people. Factor 3 (F3) consists of eight items assessing externally oriented thinking. The internal reliabilities of the total, F1, F2, and F3 scores meet the recommended standard value (Cronbach's alpha $>.70$).[16]

### Biological measurements

Blood was drawn in the morning after an overnight fast of at least 12 h, before dialysis in PD and HD patients. In all the patients, the levels of fasting plasma glucose (mg/dL), hemoglobin (g/dL), serum total cholesterol (mg/dL), triglycerides (mg/dL), high-density lipoprotein (HDL) (mg/dL), low-density lipoprotein (LDL) (mg/dL), azotemia (mg/dL), calcium (mg/dL), phosphorus (mg/dL), Ca*P (mg/dL), natrium (mEq/L), potassium (mEq/L), C reactive protein (mg/dL), were measured using standard automated techniques. The estimation glomerular filtration rate (eGFR) was calculated with the abbreviated modification of diet in renal disease formula, as defined by Levey et al.[17]

### Statistical analyses

Results are reported as mean values ± standard deviations (SD) for dependent variables.

ANOVAs (Fisher $F$) were performed in order to test differences among the four groups of patients (PD, HD, CT, KT) on the dependent variables. A $p$ value of $p < .05$ was considered significant. Statistical analyses were performed using Statistica Version 5.1 software (StatSoft, Tulsa, OK).

## Results

General information of CKT patients has been reported in Table 1. KT patients (47.9 ± 11.4; F/M: 1/8) were significantly younger ($F(3,75) = 9.6$; $p = .00001$) than PD (64.6 ± 10.6; $p = .0001$; F/M: 4/15), HD (63.3 ± 11.0; $p = .0001$; F/M: 16/19), and CT (71.0 ± 7.9; $p = .0001$; F/M: 3/13) patients.

In Table 2, SF-36 variables did not show any significant difference among the groups.

As regard to SHAPS variables, only the sensorial experiences dimension showed an effect among groups ($F(3,75) = 4.4$; $p = .006$) whereas PD patients (3.52 ± 0.84) presented significantly lower scores than HD (3.9 ± 0.3; $p = .003$), CT (4.0 ± 0.0; $p = .002$), and KT patients (4.0 ± 0.0; $p = .011$).

Moreover, TAS-20 F3 dimension showed a significant effect among the four groups ($F(3,75) = 3.9$; $p = .012$) where HD patients (18.4 ± 5.1) showed significantly lower values than CT patients (23.2 ± 4.7; $p = .001$).

As shown in Table 3, blood urea nitrogen ($F(3,75) = 14.2$; $p = .001$), potassium ($F(3,75) = 4,3$; $p = .007$), calcium ($F(3,75) = 3.9$; $p = .001$), phosphorus concentration ($F(3,75) = 19.0$; $p < .0001$), hemoglobin level ($F(3,75) = 8.2$; $p = .0001$) showed a significant effect among groups.

Post hoc comparisons showed that: PD patients (122.8 ± 47.9) had significantly higher blood urea nitrogen values than CT patients (81.1 ± 40.3; $p = .001$); moreover, HD patients (141.6 ± 32.0) presented significantly higher blood urea nitrogen values than KT patients (69.8 ± 34.5; $p = .0001$); PD patients (4.5 ± 0.6) presented significantly lower potassium values than HD (5.1 ± 0.7; $p = .28$) and KT patients (5.1 ± 0.4; $p = .009$); HD patients (8.5 ± 1.4) presented significantly lower

**Table 1.** General information of CKD patients groups.

| | Peritoneal dialysis ($n = 19$) (PD) | Hemodialysis ($n = 35$) (HD) | Conservative treatment ($n = 16$) (CT) | Kidney transplant ($n = 9$) (KT) | Total ($n = 79$) |
|---|---|---|---|---|---|
| Gender F/M | 4/15 | 16/19 | 3/13 | 1/8 | 24/55 |
| Age (years) | 64.6 ± 10.6 | 63.3 ± 11.0 | 71.0 ± 7.9 | 47.9 ± 11.4 | 63.4 ± 12.0 |
| Treatment duration (months) | 41.0 ± 33.0 | 82.4 ± 91.3 | 38.2 ± 89.6 | 82.3 ± 55.9 | 63.8 ± 78.6 |

**Table 2.** ANOVAs and post hoc comparisons among the different chronic kidney disease treatments (Peritoneal dialysis, Hemodialysis, Conservative treatment, and Kidney transplant) on Short Form Health Survey, Snaith–Hamilton Pleasure Scale, and Toronto Alexithymia Scale dimensions.

| | Peritoneal dialysis ($n = 19$) (PD) | Hemodialysis ($n = 35$) (HD) | Conservative treatment ($n = 16$) (CT) | Kidney transplant ($n = 9$) (KT) | $F(3,75)$ | $p$ | Post hoc |
|---|---|---|---|---|---|---|---|
| Short form health survey | | | | | | | |
| Physical functioning | 55.5 ± 34.2 | 46.9 ± 29.0 | 54.4 ± 30.5 | 68.9 ± 32.6 | 0.9 | .450 | – |
| Role-physical functioning | 39.5 ± 44.3 | 32.6 ± 40.0 | 37.5 ± 40.8 | 27.8 ± 42.3 | 0.2 | .881 | – |
| Bodily pain | 54.9 ± 27.7 | 42.3 ± 24.5 | 48.4 ± 26.3 | 61.1 ± 41.6 | 2.1 | .110 | – |
| General health | 38.5 ± 21.4 | 33.8 ± 23.1 | 46.0 ± 19.1 | 41.1 ± 27.1 | 1.1 | .337 | – |
| Vitality | 50.3 ± 23.2 | 43.5 ± 23.5 | 46.2 ± 22.2 | 59.4 ± 25.3 | 1.2 | .360 | – |
| Social functioning | 61.8 ± 31.3 | 55.5 ± 32.7 | 54.7 ± 23.2 | 80.5 ± 23.5 | 1.9 | .138 | – |
| Role-emotional functioning | 43.7 ± 44.5 | 40.8 ± 43.3 | 45.8 ± 41.9 | 66.7 ± 40.8 | 0.9 | .458 | – |
| Mental health | 61.9 ± 24.8 | 57.9 ± 29.2 | 51.2 ± 22.5 | 67.5 ± 17.7 | 0.9 | .446 | – |
| Snaith-hamilton pleasure scale | | | | | | | |
| Total score | 12.4 ± 2.6 | 13.0 ± 1.2 | 13.4 ± 0.7 | 14.0 ± 0.0 | 2.5 | .067 | KT > PD ($p = .014$) |
| Interest/pastimes | 3.5 ± 1.1 | 3.4 ± 0.9 | 3.6 ± 0.6 | 4.0 ± 0.0 | 1.4 | .233 | – |
| Food/drink | 1.7 ± 0.7 | 1.8 ± 0.3 | 2.0 ± 0.0 | 2.0 ± 0.0 | 2.2 | .098 | CT > PD ($p = .024$) |
| Social interaction | 3.7 ± 0.4 | 3.8 ± 0.3 | 3.8 ± 0.4 | 4.0 ± 0.0 | 1.1 | .359 | – |
| Sensory experience | 3.5 ± 0.8 | 3.9 ± 0.3 | 4.0 ± 0.0 | 4.0 ± 0.0 | 4.3 | .006 | KT > PD ($p = .011$)<br>HD > PD ($p = .003$)<br>CT > PD ($p = .002$) |
| Toronto alexithymia scale | | | | | | | |
| Total score | 48.8 ± 12.9 | 45.4 ± 14.1 | 53.6 ± 9.8 | 42.9 ± 10.0 | 2.0 | .117 | – |
| F1 ability to identify feelings | 14.7 ± 7.9 | 15.4 ± 6.8 | 17.6 ± 5.5 | 11.5 ± 3.7 | 1.6 | .183 | – |
| F2 ability to describe feelings | 13.7 ± 5.1 | 11.6 ± 5.3 | 12.9 ± 2.3 | 10.0 ± 3.5 | 1.6 | .186 | – |
| F3 externally oriented thinking | 20.5 ± 3.8 | 18.4 ± 5.1 | 23.2 ± 4.7 | 21.2 ± 5.3 | 3.9 | .012 | CT > HD ($p = .001$) |

**Table 3.** ANOVAs and post hoc comparisons among the different chronic kidney disease treatments (Peritoneal dialysis, Hemodialysis, Conservative treatment, and Kidney transplant) on the biological markers of adherence.

| | Peritoneal dialysis ($n = 19$) (PD) | Hemodialysis ($n = 35$) (HD) | Conservative treatment ($n = 16$) (CT) | Kidney transplant ($n = 9$) (KT) | $F(3,75)$ | $p$ | Post hoc |
|---|---|---|---|---|---|---|---|
| Nitrogen | 122.8 ± 47.9 | 141.6 ± 32.0 | 81.1 ± 40.3 | 69.8 ± 34.5 | 14.1 | <.0001 | PD > CT ($p = .001$)<br>HD > KT ($p = .0001$) |
| Potassium | 4.5 ± 0.6 | 5.1 ± 0.7 | 4.8 ± 0.5 | 5.1 ± 0.4 | 4.3 | .007 | HD > PD ($p = .028$)<br>KT > PD ($p = .009$) |
| Calcium | 8.9 ± 0.7 | 8.5 ± 1.4 | 9.8 ± 2.4 | 10.0 ± 0.5 | 3.9 | .01 | CT > HD ($p = .008$)<br>KT > HD ($p = .008$) |
| Uricemia | 4.9 ± 1.6 | 6.1 ± 1.3 | 6.0 ± 2.3 | 6.0 ± 1.8 | 2.5 | .065 | HD > PD ($p = .009$) |
| Phosphorus | 7.9 ± 2.9 | 5.1 ± 1.5 | 3.7 ± 0.7 | 3.9 ± 0.9 | 19.0 | <.0001 | PD > HD ($p = .0001$)<br>PD > CT ($p = .0001$)<br>PD > KT ($p = .0001$)<br>HD > CT ($p = .012$) |
| Hemoglobin | 11.9 ± 0.7 | 11.1 ± 1.3 | 12.6 ± 1.4 | 13.2 ± 1.3 | 8.2 | .0001 | CT > HD ($p = .0009$)<br>KT > HD ($p < .0001$)<br>KT > PD ($p < .014$) |
| Plasma glucose | 95.3 ± 13.8 | 111.2 ± 39.0 | 96.3 ± 15.0 | 94.1 ± 23.9 | 1.5 | .23 | – |
| Blood lipid level | 184.1 ± 68.6 | 187.5 ± 106.0 | 139.7 ± 65.3 | 224.3 ± 136.2 | 1.5 | .23 | KT > CT ($p = .047$) |

calcium values compared to CT (9.8 ± 2.4; $p = .008$), and KT patients (10.0 ± 0.5; $p = .008$); PD patients (4.9 ± 1.2; $p = .009$) presented significantly lower serum uric acid values than HD patients (6.1 ± 1.3); PD patients (7.9 ± 2.9) presented significantly higher phosphorus concentration than HD patients (5.1 ± 1.5; $p = .0001$), CT (3.7 ± 0.73; $p = .0001$) and KT patients (3.9 ± 0.9; $p = .0001$). Moreover, HD patients (5.1 ± 1.5) presented significantly higher phosphorus concentration than CT patients (3.7 ± 0.7; $p = .012$). HD patients (11.1 ± 1.3) showed significantly lower hemoglobin levels than CT (12.6 ± 1.4; $p = .0009$) and KT (13.2 ± 1.3; $p < .0001$) patients; PD patients (11.9 ± 0.7) presented significantly lower hemoglobin levels than KT (13.2 ± 1.3; $p = .014$).

Finally, in PD patients, TAS-20 F3 dimension showed a significant negative correlation with hemoglobin levels ($r = -.69$; $p = .001$) and a mild positive correlation with phosphorus concentration ($r = .45$; $p = .050$).

## Discussion

Patients treated with PD showed higher levels of anhedonia mainly in the sensorial experience dimension and higher levels of serum phosphorus suggesting a lack of adherence to the treatment. This finding confirms that PD patients have greater difficulties to adhere to the treatment and to the dietetic regimen.[13] The lower capacity to feel pleasure in sensorial activities, such as eating, reflected the greater difficulty to adhere to the dietetic regimen. A possible explanation of these findings is that in PD patients the pathological condition invades the home environment causing difficulties in the perception of pleasure during their daily activity.[18,13] Coherently with a previous study,[19] the findings of the present study suggest that despite the peritoneal treatment allows the patients to take responsibility about self-control and management of dietetic regimen, it seems that this greater autonomy could produce a lower self-management and a lower adherence to medication regimen. Patients undergoing PD need more attention by medical staff as their experienced psychological stress could affect adherence to treatment, as shown in previous studies in patients undergoing KT.[20,21]

HD and PD patients showed significantly lower levels of hemoglobin than CT and KT patients. Moreover, only in PD patients, hemoglobin levels were inversely correlated with TAS-20 F3 dimension. This finding confirms the recent hypothesis that hemoglobin levels could be affected by the psychological status of dialyzed patients.[22]

Patients undergoing peritoneal treatment showed significantly higher concentration of phosphorus. Moreover, phosphorus level in PD patients was mildly correlated with TAS-20 F3 dimension suggesting that a psychological support could be useful to increase the adherence in PD patients with a greater difficulty to elaborate emotions, as shown in a previous study.[23] Previous studies investigated the relationship between serum phosphorus and CKD progression,[24–26] suggesting that phosphorus is an independent predictor of CKD progression and cardiovascular mortality. Short-term studies have shown that dietary phosphate reduction effectively decreases FGF-23 levels that seem to be a direct cause of left ventricular hypertrophy.[26,27]

Therefore, a significant reduction of phosphorus concentration should be recommended in end stage CKD patients in order to reduce systemic complications of dialyzed patients and cardiovascular risk. The results of the present study suggest to plan researches in order to

test whether specific psycho-social treatments could increase self-control and management of dietetic regimen in peritoneal patients.[28,29]

Another important finding was that patients managed with conservative therapy showed greater emotional impairment with a lower attitude to feel and deal with their emotions compared to patients treated with HD. The interpretation of this data could be that patients in the first stages of the CKD could avoid to focus their attention on internal emotional state. Patients could implement this defense mechanism in order to keep themselves away from depressive feelings related to their chronic condition, as reported in previous studies.[10,30] On the other hand, in patients treated with HD, the impact of the treatment on their life style could prevent the possibility to avoid the emotional consequences of their illness status. This result suggests to plan a psycho-social treatment on patients treated with conservative therapy in order to help them in the management of the emotional states associated to their condition.

An important limitation of the present study was that we did not measure the adherence perception of the patients. It could be interesting to compare it with the biological marker of patients' adherence.

In conclusion, the present study showed that peritoneal treatment could decrease psychological well being and adherence to treatment in end stage CKD. The results suggest to plan psychosocial intervention in order to increase emotional ability and the adherence to the therapeutic regimen, reducing cardiovascular risk since the first stages of CKD.[20]

## Disclosure statement

The authors report no conflicts of interest.

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